VOLUNTEER EMERGENCY AMBULANCE ECONOMICS IN RURAL OHIO

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Introduction

Traditionally, funeral homes have been the primary provider of emergency ambulance service (EAS) in rural areas [1,3,4,5]. However, the passage of certain Federal laws (National Highway Safety Act of 1966 [7] and the Emergency Medical Services Systems Act of 1973 [2]) intended for the improvement of the quality and quantity of emergency medical services have made it increasingly uneconomical for funeral homes to continue providing emergency ambulance service. Subsequently, many funeral homes in rural areas have discontinued this service [8,9].

With the decline in the number of funeral homes providing emergency ambulance service, rural communities have had to find other alternatives for providing emergency ambulance service. One alternative of growing popularity is the use of volunteer organizations to provide emergency ambulance service. However, adequate economic information has not been

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1/ This study was the basis for an M.S. thesis by William Manz [6] and is the second of a two-part consideration of rural volunteer emergency ambulance services. While this study concentrated on the cost and financing of volunteer emergency ambulance services, the first study focused upon response time as a measure of service quality. Both studies are part of a regional research project in the North Central States (NC-123) and were funded under OARDC Project No. 461, Economic Analysis of Selected Community Services in Rural Ohio, in the Department of Agricultural Economics and Rural Sociology, The Ohio State University.

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readily available to assist rural community leaders in the planning and operation of volunteer ambulance service. To provide these leaders with such information, a recent study analyzed the cost and financing of a sample of 26 volunteer emergency ambulance services located in eight nonmetropolitan Ohio counties (see Appendix A).

General Sample Characteristics

Table 1 presents a summary of the major characteristics analyzed for the 26 volunteer emergency ambulance services. The majority of services surveyed (70.3 percent) were associated with township and/or village governments. Over 80.0 percent of the services were associated with local volunteer fire departments. Less than 20.0 percent were independent organizations, i.e., a volunteer organization operating strictly for the purpose of providing emergency ambulance service. The average volunteer ambulance service had been in operation for 7.4 years, with a range of one to 27 years of operation. It was found that 23 percent of the services had been organized since 1974. The mean for the number of active volunteers was 28. The smallest organization had 15 active volunteers, while the largest organization had 45.

The service areas, i.e., the area covered by the volunteer emergency ambulance service, generally followed township boundaries. The size of the service areas ranged from 23 to 174 square miles, with an average size of 79 square miles. The average population of the service areas was 4300 people and ranged from a low of 910 people in the smallest service areas to 8900 people in the largest. Considerable variation also existed in the number of ambulance runs per year which ranged from a low of 35 runs to a high of 462. The mean number of annual ambulance runs for the volunteer emergency ambulance services surveyed was 198.5.

TABLE 1

Costs, Output, Quality, Service Conditions, Demand Factors and Service Characteristics for a Sample of Volunteer Emergency Ambulance Services in Rural Ohio (n=26)

Factors	Mean	Percent	Standard Deviation	Range
Service Costs				
Variable Cost (dollars)	$3,866.25		2032.61	284.10 - 9,016.47
-variable cost per run	20.28		9.49	7.49 - 41.33
-variable cost per capita	0.90		0.54	0.26 - 3.04
Fixed Cost (dollars)	$3,871.66		2473.03	1,664.23 - 13,219.00
-fixed cost per run	25.54		18.49	8.06 - 86.11
-fixed cost per capita	1.06		0.62	0.35 - 2.60
Total Cost (dollars)	$7,437.90		4180.58	2,843.80 - 22,235.00
-total cost per run	45.82		23.73	22.59 122.82
-total cost per capita	1.96		0.99	0.71 - 5.64
Output Measures				
Number of annual ambulance runs	198.46		127.97	35.0 - 462.0
Population of service area	4,300.14		2163.14	910.0 - 8,931.0
Quality Measures				
Average response time (minutes)	8.88		3.19	4.00 - 15.00
Distance to scene (miles)	3.62		2.17	1.00 - 8.00
Distance to the station (miles)	1.35		1.26	0.00 - 4.00
Time to the scene (minutes)	5.50		2.58	2.00 - 11.00
Time to the station (minutes)	3.38		1.53	0.00 - 6.00
Service Condition Factors				
Square miles in service area	78.69		44.07	23.30 - 174.70
Percent of population in village	24.15		21.74	0.00 - 72.50
Population density	68.22		56.65	18.09 - 290.84
Location of ambulance				
-In village		61.5		
-Outside of village		38.5		

TABLE 1 (continued)

Factors	Mean	Percent	Standard Deviation	Range
Demand Factors				
Percent of population over 65	10.85		2.39	6.00 - 15.50
Percent of population under 18	36.13		4.23	22.50 - 43.00
Per capita property tax (dollars)	13.01		5.91	6.40 - 35.68
Per capita income (dollars)	2,751.31		329.39	2,068.00 - 3,225.00
Service Characteristics				
Years in service	7.35		8.13	1.00 - 27.00
Number of facilities in squadroom	10.23		4.84	2.00 - 18.00
Annual social events	2.50		2.72	0.00 - 13.00
Number of volunteers	27.65		9.18	15.00 - 45.00
Meetings (formal and informal)	3.11		2.74	0.00 - 7.00
Affiliation				
-Volunteer fire department		80.8		
-Independent		19.2		
Government agency responsible to:				
-Village		15.38		
-Township		38.46		
-Village and township		19.23		
-Fire District		3.85		
-Independent		19.23		
-County		3.85		

The mean average response time for the volunteer emergency ambulance services was 8.9 minutes. This ranged from a low of four to a high of 15 minutes. Response time is an important measure of quality and includes delay time (the time from when the call is received until the ambulance leaves the station) and travel out time (time of travel from the station to the scene of the emergency). On the average, 3.4 minutes elapsed from when the call was received until the ambulance left the station. This ranged from no measurable amount of time to a high of six minutes. The travel out time ranged from two to 11 minutes and averaged 5.5 minutes.

Revenues and Volunteer Effort

Normally, property taxes would be expected to be the primary source of revenue for rural government services. However, this was not the case with the 26 volunteer emergency ambulance services surveyed. Taxes were found to be the second most significant source of revenue, providing an average of 35.7 percent of the surveyed services' total revenues. The most significant source of revenue was non-tax sources of support. This source provided an average of 43.3 percent of the services' total revenues. This category of support included fund raising events, user charges, and donations. The third source of support was intergovernmental revenues which made up 21.0 percent of the total revenues for the services surveyed. The primary form of intergovernmental revenue was from service contracts with other communities. Contracts provided 69.0 percent of the intergovernmental revenues or 14.4 percent of the total revenues. The remaining 31.1 percent of the intergovernmental revenues or 6.6 percent of the total revenues came from Federal and/or State grants.

Volunteer EAS effort is an important "revenue" or "cost" factor depending on one's perspective. However, most analyses of community services have not attempted to attach a monetary value to volunteerism. In this study, three methods were used to impute a value for volunteer effort. The first method determined what it would cost to replace the volunteers with full-time paid personnel based upon an equivalency ratio of three volunteers to one professional squadman. The second method determined what it would cost to replace the volunteers based upon the minimum number (5.7) of professional squadman required to staff an ambulance. The third method determined what it would cost the community to compensate the volunteers for their time in making emergency runs. The average imputed values for the three methods ranged from a low of $2,875.71 (method #3) to a high of $85,785.00 (method #1) per year for the 26 EAS units surveyed.

Costs and Related Factors

Considerable variation was found in non-volunteer total and unit costs of the services surveyed. The total non-volunteer costs of the services surveyed were divided into two categories: fixed costs and variable costs. Total variable costs include expenditures associated with the output level of the service. The variable costs ranged from $284.00 to $9,016.47 per year and averaged $3,866.25 per year. Total fixed costs include expenditures which exist regardless of the level of service output. The fixed costs of the 26 volunteer emergency ambulance services averaged $3,871.66 per year, with a range of $1,664.23 to $13,219.00 per year.

The total costs of the 26 volunteer emergency ambulance services surveyed averaged $7,437.90 per year. These ranged from a low of $2,843.80 per year to a high of $22,235.00 per year. On a per run basis, the total costs of

the services averaged $45.82 with a range of $22.59 to $122.82 per run. Total costs per capita ranged from $0.71 to $5.64 per capita and averaged $1.96 per capita.

Several factors were identified as potentially significant in explaining the variation in unit costs among the 26 volunteer emergency ambulance services surveyed. These factors were categorized as follows: measures of service output, measures of service quality, conditions of the service area influencing input requirements, organizational characteristics, and demand factors.

Regression analysis conducted on these factors found from 34.0 to 84.0 percent of the variation in the costs explained by these factors or independent variables. Two independent variables were included in all runs of the model, while the other independent variables were permitted to enter only if they were statistically significant. An output variable (either the number of runs or the population of the service area was included in all runs to determine if size "economies" and/or "diseconomies" were associated with the operation of the 26 volunteer emergency ambulance services in the sample. A quality variable (response time) was included in all the runs of the model to control for any variation which existed in this variable and to be consistent with the specifications of a quasi-cost function.[3/]

Factors other than output and quality found to be significant in at least one of the runs of the model are as follows: 1) the number of years the service has been in operation, 2) the number of facilities in the squad-room or lounge, 3) the number of annual social events, 4) the size of the service area, 5) the average per capita property tax of the service area,

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3/ A forthcoming research bulletin presents a detailed account of the statistical model and results.

6) the percent of the service area population over 65 years old, and 7) the percent of the service area population under 18 years old.

Size Economies

From the statistical relationship between per unit total annual costs and output of the services, it was established that size "economies" exist in the operation of volunteer emergency ambulance services. On a per run basis, total annual cost reaches a minimum at 335 annual ambulance runs. On a per capita basis, total annual cost reaches a minimum at 5,875 people. Variation in the services' quality was controlled for by including a measure of service quality (response time) in the model.

The size "economies" associated with the operation of volunteer emergency ambulance services in rural areas implies that most services could significantly reduce unit costs by expanding output. It was found that 20 of the 26 services surveyed or 76.9 percent were operating at less than optimum size. Furthermore, the measures of output quality did not vary significantly for those services which were less than optimum size and those which were above optimum size. The average total response time for the services above the optimum size was 9.8 minutes, while the average total response time for the services below the optimum size was 8.7 minutes.[4/] The important point is that most of the services were well below the 15 minute maximum response time rule of thumb frequently quoted.

Although 76.9 percent of the services were operating at levels of output below the optimum size, the question of whether these services can expand without overlapping other organizations' service areas still remains.

4/ However, population density was 30 percent higher in the above vs. below optimum size services and this factor was not specifically incorporated into the final statistical model.

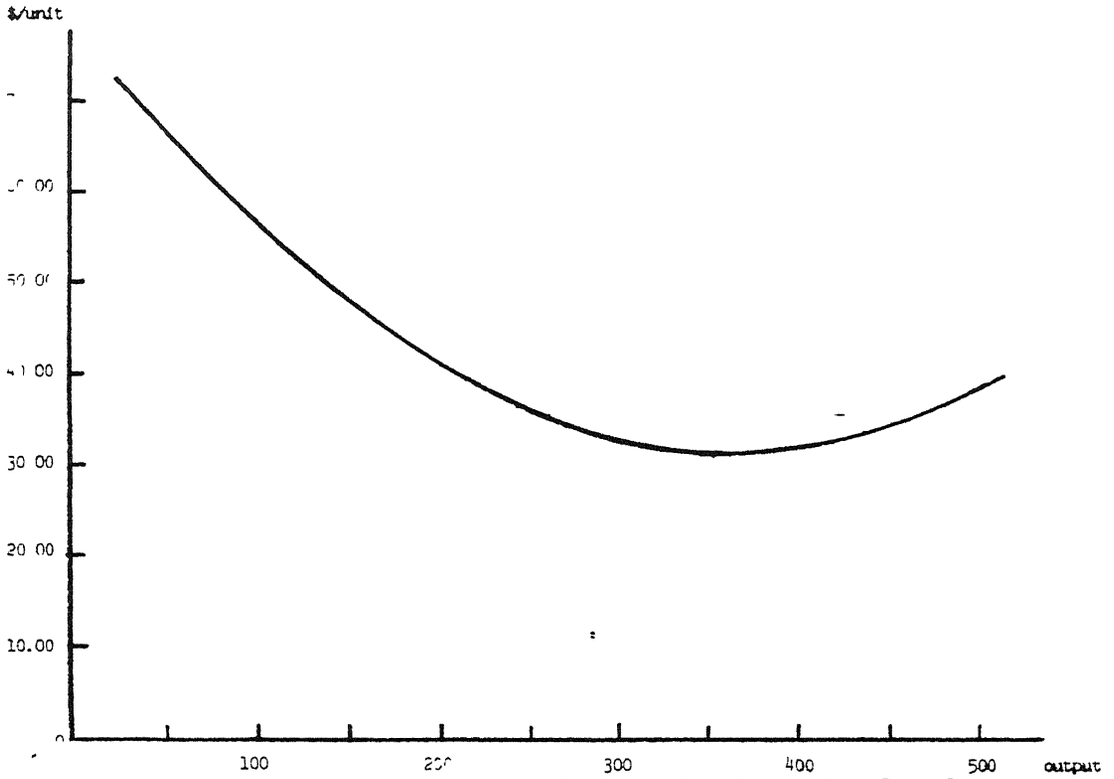


Figure I: Total Cost Per Run Quadratic Function for a Sample of Volunteer Emergency Ambulance Services (n=26)

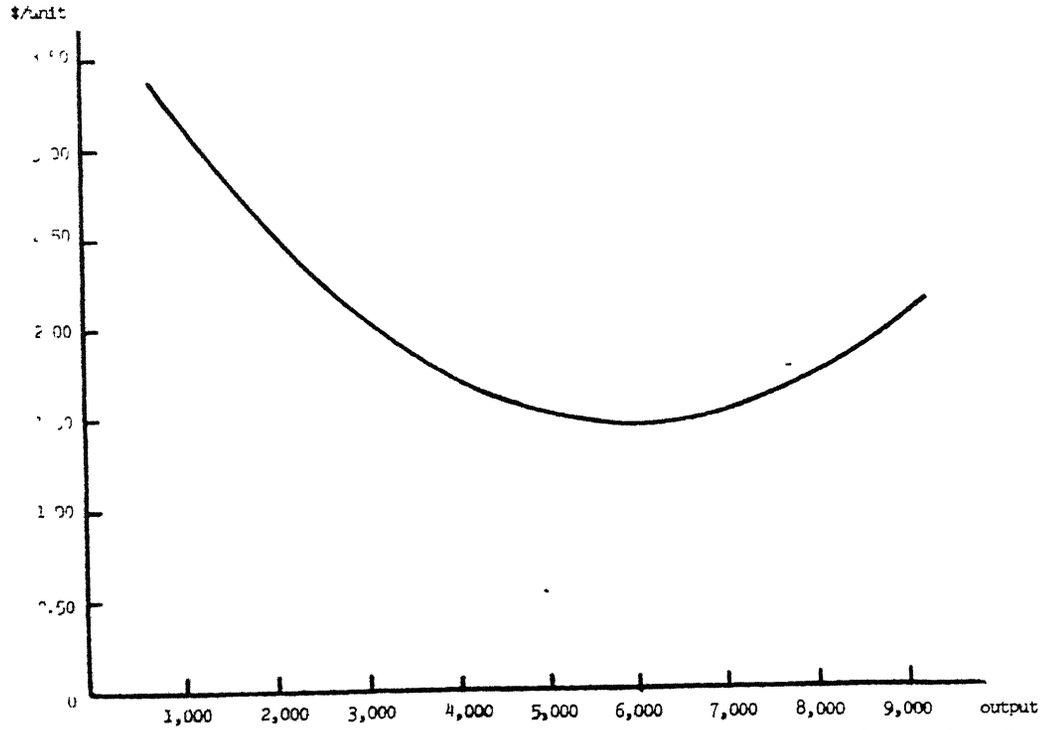


Figure II: Total Costs Per Capita Quadratic Function for a Sample of Volunteer Emergency Ambulance Services (n=26)

To determine the potential for expansion, the proportion of the area and population covered by emergency ambulance services was estimated for the eight sample counties. These results are summarized in Table 2.

Volunteer organizations covered an average of 51.7 percent of the area within the counties surveyed, with a range of 15.7 to 92.8 percent. The county population covered by volunteer organizations averaged 37.3 percent and ranged from 7.1 to 70.0 percent. The area covered by other organizations averaged 15.1 percent, while the population protected by these other organizations averaged 44.5 percent. These ranged from 21.3 to 100.0 percent and 25.2 to 66.0 percent, respectively. The area covered by both categories of ambulance services averaged 71.1 percent and ranged from 21.3 to 100.0 percent. The population protected by both categories averaged 84.0 percent and ranged from 52.6 to 100.0 percent.

These results indicate that the potential for expanding into uncovered areas varies considerably. In two of the counties, substantial potential exists for expansion, while in three counties there is little or no potential for expansion. This assumes that the existing services, including some inefficient volunteer emergency ambulance services and funeral homes are not eliminated. In the two counties which were totally covered, 50.0 percent of the volunteer emergency ambulance services were operating at less than optimum size. It should be noted that 42.8 percent of the funeral homes still providing emergency ambulance service are located in villages or areas other than the county seat. This would imply that these areas could be potentially covered by a volunteer service since most of the funeral homes will probably eventually discontinue their emergency operations.

TABLE 2

Emergency Ambulance Coverage in a Sample of Nonmetropolitan Ohio Counties (n=8)

County No.	Square Mile Coverage (%)			Population Coverage (%)		
	Volunteer	Funeral Homes and Other	Total	Volunteer	Funeral Homes and Other	Total
1	57.4	14.5	71.9	56.5	25.2	81.7
2	15.7	5.6	21.3	7.1	45.5	52.6
3	84.8	15.0	99.8	70.0	30.0	100.0
4	92.8	7.2	100.0	55.1	44.9	100.0
5	19.0	N.A.	N.A.	21.7	N.A.	N.A.
6	82.5	2.6	85.1	53.7	39.0	92.7
7	22.7	32.9	55.6	14.1	60.7	74.8
8	38.5	29.9	68.4	20.0	66.0	86.0
Total	51.7	15.4	71.7	37.3	44.5	84.0

Implications

It has been suggested that the use of volunteer effort and non-tax sources of revenue may potentially effect (reduce) the amount of Federal revenue sharing funds received by rural communities. The most conservative value of volunteer effort and/or non-tax sources of support in respect to the tax effort of the service area was examined to determine the potential effect of these factors upon the "tax effort" factor in the Federal revenue sharing formula. The value of volunteer effort averaged 4.8 percent of the service areas' tax effort, and ranged from .4 to 14.7 percent. Non-tax sources of support averaged 5.8 percent of the service areas' tax effort and ranged from zero to 51.1 percent. When these two factors are combined, their effect averaged 10.6 percent of the service areas' tax effort. More analysis is needed of this question with other community services.

Two methods are available for volunteer emergency ambulance services to increase the level of output in order to take advantage of the size "economies" which exist. The first method is through consolidation, i.e., combining communities or units of local government in order to provide emergency ambulance service. This generally takes the form of districts similar to the fire districts used to provide fire protection in rural areas. This study did not find this to be a popular method for providing emergency ambulance service. Only one of the 26 volunteer emergency ambulance services could be defined as a district. Guidelines for Ohio have been established by Amended House Substitute Bill No. 1173 for communities wishing to form a service district for emergency ambulance service. The guidelines are summarized in Appendix B.

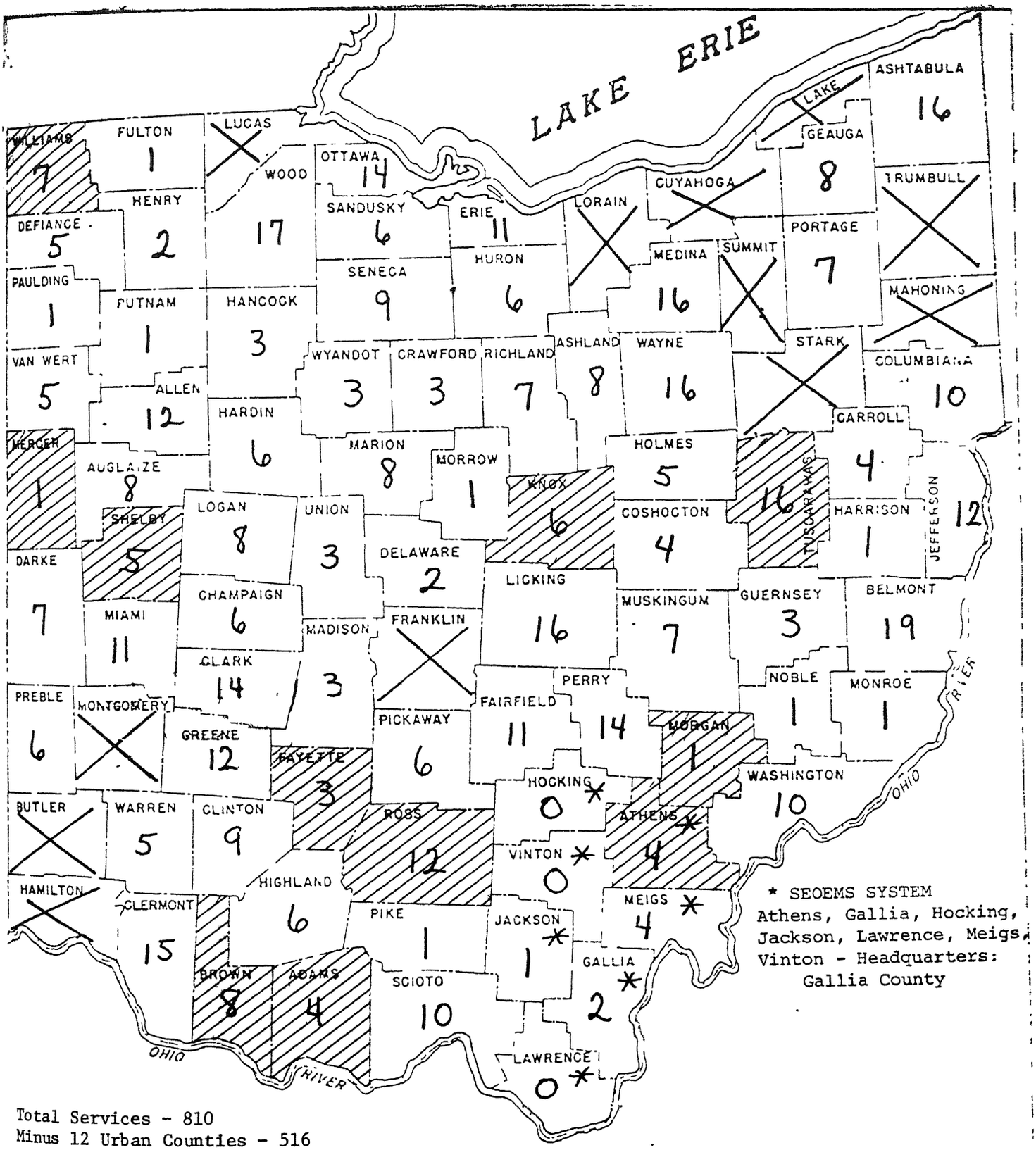
The second method by which volunteer emergency ambulance services can expand output is through the use of service contracts. This study found

several service contracts used for increasing service output as well as extending service to communities lacking adequate resources to provide their own EAS. They usually involved a township or village contracting to provide emergency ambulance service to a township or village without a service of their own.

Assistance and information on financing is available from the Emergency Medical Service Division, Ohio Department of Health for communities wishing to establish an EAS service district or contractual arrangement. In addition, communities can secure help from the local Cooperative Extension Service or by contacting Mr. Philip Grover of the Ohio Cooperative Extension Service, 2120 Fyffe Road, Columbus, Ohio, 43210.

APPENDIX A

Distribution of Ambulance Services By County With Urbanized Population Of Less Than 150,000 - 1975



* SEOEMS SYSTEM
Athens, Gallia, Hocking, Jackson, Lawrence, Meigs, Vinton - Headquarters: Gallia County

Total Services - 810
Minus 12 Urban Counties - 516

Counties in Sample

SOURCE: Ohio Department of Health - EMS Division

APPENDIX B

Am. Sub. H.B. 1173
(As reported by the S. Trans. & Local Gov't. Comm.)

Reps. Boggs - Riffe - Cox - Deering - Camera - Carney - Roberto - Netzley - Hadley - Kieffer - Pope - Swanbeck - Fiocca - Malott - Mueller - Maier - Speck - Pease - Wargo - Weyandt - Orlett - Hiestand - Scott
Sens. Johnson - Secrest - Corts

-Permits townships and municipalities to establish joint ambulance districts with borrowing and taxing authority and specific authority to contract for ambulance services.

-Authorizes political subdivisions to propose special purpose property tax levies to finance ambulance and emergency medical services.

PURPOSE

Some townships and municipalities have contracted for ambulance service without statutory authorization, according to the State Auditor's Office, and it is the stated purpose of this bill to provide authority for that service and creation of joint ambulance districts in the event local governments wish to combine for the purpose of providing ambulance service.

CONTENT AND OPERATION

Contracting authority

A State Auditor's Office opinion stated that an ambulance service cannot contract with a municipality for a fixed amount per month or year and also charge the recipient of that service. To obtain ambulance services, or additional service in emergencies, this bill authorizes a joint ambulance district (see below) to contract for ambulance service and to furnish to or receive services from, or interchange services with one or more townships, municipalities, joint fire districts, other governmental units that provide ambulance service, or private ambulance services, regardless of whether such private or government owners of the service are located within or without Ohio. Contracts could not exceed three years and would have to be authorized by all boards of trustees and legislative authorities concerned.

The contract may be based on a fixed annual charge, a charge per call, a charge based on elapsed time; or any combination of the foregoing. The bill states specifically that ambulance service expenditures are lawful regardless of whether the district or the contractor charges additional user fees.

Joint ambulance district

Two or more townships, two or more municipalities, or a combination of municipalities and townships could join together to establish a joint ambulance district under provisions of the bill. Joint ambulance districts would be formed by majority approval of a resolution by the board of township trustees and the legislative authority of the municipalities working to form the district.

Districts would have authority under the Uniform Bond Law and the Uniform Tax Levy Law to submit bond issue and property tax levy questions to the voters, provide or contract for ambulance services, furnish ambulance service to governmental units, and to employ, fix the compensation of, and initiate removal proceedings of personnel. A district would be governed by a board of trustees, comprised of a representative appointed by the board of trustees of each township and a representative appointed by the legislative authority of each municipality in the district.

Trustees would be empowered to employ a clerk, who would be required to submit a performance bond, to serve the board of trustees. Trustees would be paid up to $20 per meeting, for not more than 12 meetings per year, and reimbursed for necessary expenses.

Other townships and municipalities could by resolution request membership in a joint ambulance district subject to the district's approval; members of the district could withdraw. A joint ambulance district would cease to exist when there was only one township or one municipality forming the entire district. At that time, assets of the district would be apportioned. If any debt of the district remained outstanding at the time of dissolution, taxes sufficient to meet those obligations would continue to be levied upon the property of the district as it was comprised at the time the indebtedness was incurred.

The bill does not permit suits to be initiated against a district to recover damages or loss to persons or property or for a wrongful death. Employees would not be liable for damages, injury, or loss to persons or property, or for wrongful death arising from operation of a publicly or privately owned or leased vehicle while responding to an emergency call.

Tax levies

A political subdivision with taxing authority may ask the voters to approve tax levies in excess of the ten-mill levy limitation for specified purposes. This bill would add as a purpose for which a tax could be proposed, a levy to pay for the costs of providing ambulance, emergency medical service, or both. The levy could be proposed to run for up to five years. In addition to joint ambulance districts, created by the bill, counties and townships have statutory authority to provide ambulance service and municipal corporations, presumably, have such authority under their home rule power and could thus propose such a levy.

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HISTORY

ACTION	DATE	JOURNAL ENTRY
Introduced	2-7-74	p. 1948
Reported, H. Ways and Means	3-5-74	p. 2100
Passed House	3-12-74	p. 2139
Reported, S. Trans. & Local Gov't.	5-16-74	p. 1430

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9. Ohio Department of Health, Emergency Medical Service, Unpublished survey of all emergency ambulance service operating in Ohio conducted between 1976 and 1977.